Effects of dried sugar beet root based concentrates level on body components and carcass characteristics in Nubian goat male kids

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ABSTRACT

The increasing meat demand and prices and nutritional awareness in the Sudan showed that goat meat production is attractive. Nubian goat is the main dairy breed and culled males are important for meat production. However, nutrition is the main constraint for goat production. Sorghum cobs residues (*Seewa*) is cheap, abundant and is supplemented to improve the nutritive value. Sugar beet is introduced for sugar production in the Gezira State and is a valuable feed. There is no information on dried sugar beet roots (DSBR) based concentrates level on Nubian kids performance and carcass characteristics. Therefore, this study was conducted to furnish this vital information. Twelve Nubian male kids at 6 month old were housed in individual pens with feed and water troughs and allocated at random to three feeding levels. They were fed upgraded *Seewa* (UGS) *ad lib*. at 8 am and 4 pm and DSBR based concentrates at 0, 250g and 500g in two meals before UGS. The animals were fed for 8 weeks including a 10 days preliminary period and were then fasted overnight, weighed and slaughtered. Data was statistically analayzed using the completely randomized design. Slaughter weight, empty body weight (EBW), hot carcass weight and dressing percentages on live body weight (LBW) and EBW increased with concentrates level. Dressing percentages on LBW significantly ($P \leq 0.05$) increased and muscle, bone and fat percentages were not significantly affected with concentrates level. Bone and fat percentages increased with concentrates level and muscle percentage increased with concentrates level up to 250g and then decreased at 500g. Muscle:bone decreased and muscle:fat generally increased with concentrates level, but differences were not significant ($P>0.05$). Head, feet, skin, intestines, liver, omentum and testicles increased in weight and stomach, heart, lungs, mesentery and tail generally increased in weight with concentrates level. Spleen weight was similar in all concentrates levels. Blood, pancreas and kidneys and renal fat weight decreased with concentrates level. Most body components were heaviest in animals fed 500g concentrates. All body components weights were not significantly ($P>0.05$) affected with concentrates level, except stomach, testicles and omentum. Concentrates level had no significant effect on body components percentages. It is recommended to use DSBR based concentrates and upgraded *Seewa* in fattening Nubian male kids.

INTRODUCTION

The highly increased meat demand and prices and nutritional awareness in the Sudan showed the need to produce high quality, cheap and low fat meat and exploit less utilized animal species for meat production (Elimam *et al*., 2010). Goat meat has high nutritive value and muscles and low fat and cholesterol (Casey, 1992). The demand for goat meat increased due to the disputed correlation between cardiovascular diseases and saturated fatty acids and cholesterol (Wikipedia, 2016). Cardiovascular diseases are the main mortality causes in the world (31%).

Goat meat has balanced amino acids and proportion of saturated/unsaturated fatty acids (Banskalieva *et al*., 2000). It was reported that blood cholesterol level is less dependent on cholesterol intake in foods and is more dependent on the amounts of consumed saturated fats, especially the ratio of polyunsaturated to saturated fats (Addrizzo, 2002). Goats are important in the Sudan due to high population, wide distribution and production of high quantities of high quality milk and meat (MARF, 2011). In addition they have higher digestive efficiency for low quality feeds than sheep and cattle (Devendra and Mc Leroy, 1992).

Sudan ranked 6th in world goat population and meat production (FAOSTAT, 2008), but goats contribution is low related to their potentials. This was mainly because goat meat is the least preferred in the country and is mainly preferred as kids meat goat. In addition goat meat production is mainly traditional based on rangeland which deteriorated for many factors with low inputs and outputs. Improving goat meat production makes it competitive and increases demands, exports, other types of meat exports and national income. There are many goat breeds and Nubian is the main dairy breed and other breeds are meat producers (Devendra and Mc Leroy,1992). Culled Nubian males are used for meat production, but not well exploited.

Nutrition is the main constraint for goat meat production in the Gezira State (Elimam *et al*., 2010) due to rangeland deterioration (Abusuwar and Darrag, 2002), seasonal flactuations in feeds quantity and quality leading to serious shortages and effects on animals health and performance, especially in the dry season (Elhag, 1992). Crop residues are abundent and important feeds with generally low nutritive value and animals performance (Hamed, 2007). It is important to improve the nutritive value of crop residues and utilize cheap feeds.

Seewa is sorghum cobs residue with some grains. It is abundant and cheap, but has low nutritive value and could be upgraded by different methods including supplementation. Crop residues supplementation with concentrates and protein improved animals performance (Ma *et al*., 1990). Goats growth improved when fed up to 30% supplemented maize cobs (Ogunleke *et al*., 2014). Sugar beet (*Beta vulgaris* L.) is recently introduced into the Gezira State for sugar production and provides valuable feeds (Harland *et al*., 2006). Dried sugar beet roots (DSBR) based concentrates were recently used in fattening *Tagger* males in the Gezira State. However, there is no available information on using upgraded *Seewa* and DSBR based concentrates in Nubian male kids meat production. Consequently, this study was conducted to study the effects of DSBR based concentrates level on the performance and carcass characteristics of Nubian male kids in the Gezira State.

MATERIALS AND METHODS

Animals

Twelve Nubian male kids at 5-6 month old were used in this study. They were bought from livestock market and injected with Intermectin (Interchemie Werken, Harjumaa, Estonia) against internal and external parasites. They were weighed and divided into three groups, each with four animals.

Housing

The animals were housed in individual wire pens (1.5x2 m) in an open corral shaded with corrugated iron sheets. The pens had roughages, concentrates and drinking water troughs.

Feeds and feeding

Sorghum *Seewa* was upgraded (80% *Seewa*, 10% groundnut cakes, 2% urea, 5% molasses, 2% lime stone and1% salt). Sun cured sugar beet roots were crushed and mixed with concentrates ingredients (70% DSBR, 15% groundnut cakes and 15% sunflower cakes). The Animals groups were allocated at random to three feeding levels. They were fed upgraded *Seewa* (UGS) *ad lib*. and pre weighed UGS was fed in two equal meals at 8 am and 4 pm and refusals were collected and weighed before the morning meal for each animal. The kids were fed DSBR based concentrates at 0 (control), 250g and 500g in two equal parts before UGS meals. The animals were weighed weekly for 8 weeks including a 10 days preliminary period. The kids were offered clean drinking water *ad lib*..

Slaughter

At the end of the experiment the animals were fasted overnight and weighed before slaughter according to Islamic rituals (Elimam and Ombabi, 2007). Blood was collected in a pre- weighed plastic container and weighed. The legs were removed and the animals were skinned. The carcass was opened, eviscerated and body components were removed. Body components were separated and weighed for each animal. Carcasses were weighed with kidneys and renal fat (hot carcass weight, HCW). The alimentary tract was weighed full and empty to determine the gut fill and empty body weight (EBW). The tail, kidneys and renal fats were separated and weighed for each animal.

Calculations

The gut fill was calculated by subtracting the empty alimentary canal weight from the filled one. Empty body weight was calculated by subtracting the gut fill from slaughter weight. Body components weight was expressed as a percentage of LBW and EBW. Dressing percentages were calculated on LBW and EBW for each animal.

Statistical analysis

Data were statistically analyzed using the analysis of variance procedure.

RESULTS

Slaughter weight and carcass charteristics

Table 1 shows the effects of DSBR based concentrates level on slaughter weight and carcass characteristics in kids fed UPS *ad lib.*. Slaughter weight, EBW, hot carcass weight and dressing percentage on LBW and EBW increased with concentrates level. Slaughter weight and hot carcass weight significantly (P≤0.05) increased in animals fed 500g concentrates.
Empty body weight significantly (P≤0.05) increased with the two concentrates levels. The dressing percentage on LBW significantly (P≤0.05) increased with concentrates levels. However, dressing percentage on EBW was not significantly (p≥0.05) affected with concentrates level. Muscle, bone and fat percentages were not significantly affected with concentrates level. Bone and fat percentages increased with concentrates level and muscle percentage increased with concentrates level up to 250g and decreased at 500g. Muscle:bone decreased and muscle:fat generally increased with concentrates level, but not significantly (P>0.05).

Table 1. Effects of dried sugar beet roots based concentrates on slaughter weight and carcass characteristics in male Nubian kids in the Gezira State, Sudan.

Parameters	Concentrates level (g/day)		
	0	250	500
Slaughter weight (kg)	14.94±0.72	17.44+1.09	18.00 ± 2.79
Empty body weight (kg)	11.33±1.06	13.95 ± 0.80	14.41 ± 2.46
Hot carcass weight (kg)	5.69 ± 0.27	7.28 ± 0.64	7.75 ± 1.68
Dressing %: LBW	38.18 ± 2.33	41.69 ± 1.28	42.93 ± 2.62
EBW	50.40 ± 2.72	52.63 ± 3.10	53.45± 2.58
Carcass muscle (%)	59.69±5.53	60.25±3.13	59.43±5.18
Carcass bone (%)	21.29±13.52	23.13±5.11	23.29±3.02
Carcass fat(%)	16.67 ±9.0	16.63±7.70	17.28±6.34
Muscle: bone	2.80±0.21	2.70±0.57	2.58±0.43
Muscle: fat	3.58±3.69	4.14±1.50	3.91±1.69

LBW= Live body weight, EBW= Empty body weight.

Body components

Table 2 shows effects of DSBR based concentrates level on body components weight in kids. Head, feet, skin, intestines, liver, omentum and testicles weight increased with concentrates level. Stomach, heart, lungs, mesentery and tail generally increased in weight with concentrates level. Spleen weight was similar in all concentrates levels. Blood, pancreas and kidneys and renal fat weight decreased with concentrates level. Blood, pancreas and kidneys and renal fat were heaviest in animals fed no concentrates.

Animals fed 250g concentrates had the heaviest stomach and mesentery and animals fed 500g concentrates had the heaviest head, feet, skin, intestines, liver, omentum, testicles and tail. Most body components were heaviest in animals fed 500g concentrates. All body components weights were not significantly ($P>0.05$) affected with concentrates level, except stomach, testicles and omentum. All body components weights were least in animals fed no concentrates, except blood, spleen, pancreas, kidneys and renal fat and tail. The tail weight was least in animals fed 250g concentrates. Blood and kidneys and renal fat were least in animals fed 500 concentrates.

Table 3 shows effects of DSBR based concentrates on body components percentages in kids. Concentrates level had no significant effects on body components percentages in Nubian male kids. The percentages of head, stomach, lungs, liver, kidneys and renal fat and testicles were highest in animals fed no concentrates.The percentages of blood and skin were highest in animals fed 250g concentrates. The percentages of feet, intestines, heart, spleen, tail and omentum were highest in animals fed 500g concentrates.

Animals fed 0 and 500g concentrates had the highest number of body components with the highest percentages and animals fed 250 g concentrates had the least number of the highest body components percentages. Forefeet percentages were least in animals fed no concentrates. The percentages of hind feet, heart, spleen, pancreas, mesentry, omentum and tail were least in animals fed 250g concentrates. The percentages of blood, head, skin, stomach, lungs, kidneys and renal fat, testicles and tail were least in animals fed 500g concentrates.Animals fed 500g concentrates had more body components with the least percentages and animals fed no concentrates had only one body component with the least percentage .

Table 2. Effects of dried sugar beet roots based concentrates on body components weight (kg) in Nubian kids in the Gezira State, Sudan.

Body components	Concentrates level (g/ day)		
	0	250	500
Blood	0.87 ± 0.34	0.79 ±0.28	0.69 ± 0.08
Head	1.05 ± 0.09	1.23 ±0.09	1.25 ± 0.21
Fore feet	0.28 ± 0.02	0.32 ± 0.05	0.34 ± 0.05
Hind feet	0.25 ± 0.02	0.30 ± 0.03	0. 31 ± 0.04
Skin	0.82 ± 0.22	1.06 ± 0.26	1.07 ± 0.20
Stomach	0.52±0.09	0.64±0.03	0.59±0.07
Intestines	0.68±0.12	0.72±0.10	0.85±0.17
Gut fill	3.61±0.99	3.48±0.45	3.59±0.05
Heart	0.07 ±0.03	0.08 ± 0.04	0.08 ±0.02
Lungs	0.23 ± 0.04	0.28 ± 0.02	0.28 ± 0.08
Spleen	0.03 ± 0.01	0. 03 ± 0.01	0.03 ± 0.00
Pancreas	0.07 ± 0.09	0.03 ± 0.01	0.03 ± 0.00
Mesentery	0.12 ± 0.06	0.14 ± 0.07	0.13 ± 0.11
Kidneys and renal fat	0.08 ± 0.07	0.06 ± 0.01	0.05 ±0.02
Liver	0.26 ± 0.02	0.30 ± 0.05	0.31 ± 0.03
Testicles	0.17 ±0.02	0.19 ±0.04	0.20 ± 0.07
Tail	0.07 ± 0.08	0.03 ± 0.01	0.09 ± 0.09
Omentum	0.16 ± 0.03	0.19 ± 0.03	0.25 ±0.07

Table 3. Effects of dried sugar beet roots based concentrates on body components percentages in Nubian male kids in the Gezira State, Sudan.

Body components	Concentrates level (g/day)		
	0	250	500
Blood	4. 84 ± 3.14	5.60±1.71	3.61±2.40
Head	9.24 ± 0.32	8.85± 0.45	7.04±3.07
Forefeet	1.93 ± 1.31	2.31± 0.28	3.97± 3.36
Hind feet	2.18±0.29	1.97+0.32	2.19± 0.31
Skin	4.84±3.14	5.60± 1.71	3.61±2.40
Stomach	4.72 ±1.10	4.64 ± 0.28	4.19±0.51
Intestines	6.13 ±1.52	4.98 ± 0.96	6.16± 2.17
Gut fil	32.62± 11.94	24.97±2.78	24.23± 3.05
Heart	0.60+0.30	0.59± 0.27	0.96± 0.84
Lungs	2.04 ± 0.33	1.62±0.97	1.56± 0.82
Spleen	0.57± 0.72	0.23± 0.06	0.71±1.01
Pancreas	0.80 ± 1.11	0.21± 0.05	0.49± 0.56
Mesentery	2.22 ± 1.83	0.97± 0.64	1.17± 0.81
Kidneys and renal fat	0.86± 0.63	0.58± 0.40	0.28±0.13
Liver	2.30 ±0.32	1.68± 0.99	2.14±0.26
Testicles	1.45±0.07	1.36±0.28	1.09± 0.60
Tail	0.26 ± 0.05	0.21± 0.06	0.84 ±0.69
Omentum	1.45 ± 0.20	1.43±0.17	1.58±0.42

DISCUSSION

Slaughter weight and carcass characteristics

The increased Nubian male kids slaughter weight, EBW, hot carcass weight and dressing percentage with DSBR based concentrates level were mainly due to increased BW and improved animals performance with concentrates level. Similar results were reported in *Tagger* males fed different levels of DSBR based concentrates and groundnut haulm. The improved goats slaughter weight, EBW, hot carcass weight and dressing percentage with concentrates level was reported by many authors (Abdalla, 2004; Elimam and Ombabi, 2007). Nubian kids slaughter weight, EBW and hot carcass weight were heavier than *Tagger* males fed DSBP based concentrates. This effect was mainly genetic and was associated with Nubian males heavier BW. Dressing percentages on EBW were higher than *Tagger* and on BW were within the range for *Tagger*. Slaughter and carcass weights were generally lower than Nubian males (Gaili, 1976). Dressing percentage on LBW and EBW were lower than Nubian males (Gaili, 1976; Yassin, 1994). Nubian kids fed DSBR dressing percentages were within the range for Desert males (Elgaili, 1977). It was lower than values reported by many

workers in Desert males (Hassaballa, 1996; Elfadil, 1996). Nubian kids dressing percentage was lower than *Tagger* in Nuba Mountains (Elbukhary, 1998; Mudawi, 2002).

The generally increased muscle percentage and increased fat percentage with concentrates level were also found in *Tagger* males fed DSBR based concentrates, while the efects on bone were the opposite to that in *Tagger* males. Muscle and fat percentages were higher and bone percentage was within the range for *Tagger* males. The generally increased muscle, bone and fat percentages with concentrates level were due to improved BW and weight gain and carcass composition. Nubian males fed DSBR based concentrates had higher bone and lower fat percentages than Nubian males and muscle percentage was within the range for Nubian males (Yassin, 1994). Nubian kids fed DSBR muscle and bone percentages were within the range for Desert males and females (Hassaballa, 1996). Nubian males had higher fat than *Tagger* in Nuba Mountains (Elbukhary, 1998; Mudawi, 2002) and muscle and bone were within the range for *Tagger* (Elbukhary, 1998).

The decreased muscle: bone and generally increased muscle: fat with concentrates level were mainly due to differential growth, genetic or due to feeding level. The increased muscle: fat with concentrates level was similar to that in *Tagger* males, but the decreased muscle: bone was the reverse to that in *Tagger* males. Dried SBR based concentrates level increased muscle and fat and decreased bone in *Tagger* males. The difference between the two breeds was mainly genetic and affected by feeding level. Nubian males muscle:bone and muscle :fat were lower than *Tagger*. This was mainly due to variations in differential growth and energy partition. Muscle: bone was higher than intact and castrated males (Yassin, 1994) and within the range for *Tagger* (Elbukhary, 1998)

Body components

The generally increased weight of most body components in Nubian males was mainly due to increased BW with concentrates level. The decreased weights of blood, pancreas and kidneys and renal fat with concentrates level may be associated with body components differential growth. The non- significant effects on most body components weight was also found in *Tagger*. The similar spleen weight in all concentates levels was also found in *Tagger* males fed DSBR based concentrates. The heaviest weight of most body components at the higher feeding level was also found in *Tagger* males. The higher omentum weight at the highest feeding level in Nubian and *Tagger* males suggested similar omentum fat deposition mechanisms. The least mesentery weight in animals fed no concentrates in Nubian males and the highest concentates level in *Tagger* males suggested different mesentery fat deposition mechanisms. More precise research is required to understand concentates level differential effects on fat depots in goats The changed effects of concentrates level on body components as percentages of EBW suggested that it is better to express them in this form than absolute weight. Most body component weight was highest in animals fed 500g due to higher feeding level, weight gain and carcass characteristics. The highest omentum weight percentage at the highest concentates level was found in Nubian and *Tagger* males fed DSBR based concentrates suggesting similar fat deposition in the two breeds.The variations in concentates effects on mesentery between the two breeds suggested genetic variations between the two breeds

CONCLUSION

Dried sugar beet root based concentrates level improved Nubian male kids carcass characteristics.

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أثر المستويات المختلفة لعلف مركز يحتوي على بنجر السكر المجفف علي مكونات الجسم الثانوية وصفات ذبيحة جديان ذكور الماعز النوبي

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[2] قسم الانتاج الحيواني، كلية العلوم الزراعية، جامعة الجزيرة، ص . ب. 20، ود مدني، السودان.

الخلاصة

أدت زيادة الطلب على اللحوم وارتفاع أسعارها والوعي الغذائي في السودان لإظهار جاذبية إنتاج لحوم الماعز. الماعز النوبي هو سلالة الألبان الرئيسة والذكور المستبعدة من القطيع هامة لإنتاج اللحوم. إلا أن التغذية معوق رئيس لإنتاج الماعز. مخلفات قناديل الذرة الرفيعة (السيوة) رخيصة ومتوفرة وتدعم لتحسين القيمة الغذائية. أدخل بنجر السكر لإنتاج السكر في ولاية الجزيرة وهو علف قيم. لا توجد معلومات عن أثر مستويات مختلفة من عليقة مركزة ترتكز على الجذور المجففة لبنجر السكر على الأداء وصفات ذبيحة جديان ذكور الماعز النوبي. لذلك أجريت هذه الدراسة لتوفير هذه المعلومات الهامة. وضع 12 ذكراً من الماعز النوبي بعمر 6 أشهر في حظائر مفردة مع أوعية الأكل والماء ووزعت عشوائياً على ثلاثة مستويات تغذية. أعلفت الحيوانات مخلفات قناديل الذرة المحسنة حسب الرغبة عند الساعة الثامنة صباحا والرابعة مساءً وغذيت على عليقة مركزة ترتكز على جذور بنجر السكر المجفف عند صفر و 250 جرام و500 جرام في وجبتين قبل مخلفات قناديل الذرة المحسنة . أعلفت الحيوانات لمدة ثمانية أسابيع مع 10 أيام فترة تمهيدية. صومت الحيوانات ليلة ثم ووزنت وذبحت. زاد وزن الذبح والوزن الفارغ ووزن الذبيحة الساخن ونسب التصافي على أساس الوزن الحي والوزن الفارغ بزيادة مستوى العليقة المركزة. زادت نسب التصافي على أساس الوزن الحي معنوياً ولم تتأثر النسب المئوية للعضلات والعظم والشحم معنويا بمستوى العليقة المركزة . زادت نسب العظم والشحم بمستوى العليقة المركزة وزادت نسب العضلات بالعلف المركز حتى 250جم ثم انخفضت عند 500جم. انخفضت العضلات: العظم وعامة زادت العضلات: الشحم بمستوى العليقة المركزة ولكن بشكل غير معنوي. زاد وزن الرأس والأرجل والجلد والأمعاء والكبد والمساريقا والخصى وعامة زاد وزن المعدة والقلب والرئتين والذيل بمستوى العليقة المركزة.كان وزن الطوحال متشابها في كل مستويات العليقة المركزة. انخفضت نسب الدم والبنكرياس والكلي وشحمهما بزيادة مستوى العليقة المركزة. كانت معظم مكونات الجسم الثانوية أثقل في الحيوانات التي اعلفت 500جم عليقة مركزة. لم تتأثر اوزان كل مكونات الجسم الثانوية بمستوى العليقة المركزة إلا للمعدة والخصى ودهن الأحشاء. لم يوثر مستوى العليقة المركزة معنويا على نسب مكونات الجسم الثانوية . لذلك يوصي باستخدام جذور بنجر السكر المجفف بمستويات مختلفة مع قناديل الذرة المحسنة في تسمين ذكور الماعز النوبي.